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AUTHOR Haviland, Jeannette
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ABSTRACT

This paper argues that infants' affect patterns are innate and are meaningful indicators of individual differences in internal state. Videotapes of seven infants' faces were coded using an ethogram; the movement of the eyebrow, eye direction, eye openness, mouth shape, mouth position, lip position, and tongue protrusion were assessed independently. Nearly the whole range of facial movements was observed during the neonatal period, thus indicating that all the movements generally called smile, frown, angry grimace, excitement, boredom, sorrow, joy and shame are possible from at least the second or third week of life. Electrocardiogram data were recorded simultaneously with videotaping of the infants' faces during periods when the infants were attending to novel stimuli and were habituating to these stimuli. Analysis of these data revealed substantial co-occurrence of facial change and heart rate change, which suggests that observed infant affect is a reflection of the infants' internal state rather than a random patterning waiting to be organized. (Author)

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Individual Differences in Affect*

Jeannette Haviland
Educational Testing Service

The history of the psychological study of affect development is neither long nor varied. With few exceptions affect has been an artifact in studies of drive or cognition. Even the papers being presented in this symposium on affect (S. Escalona, M. Lewis, A. Sroufe) are oriented toward explaining how affect is related to social or intellectual functioning. While I agree (see Haviland, 1975) that affect is a useful indicator of need or of cognitive development, I am distressed at how little we know about affect itself--its forms, its origins, its development, its biological meaning and its culturally bound interpretations.

It seemed to me when I began to study affect several years ago that psychologists, particularly developmental psychologists, were setting themselves up to see only what they wanted to see of affect. For affect to be "worth" studying it had to be a repetitiously reliable phenomenon--repetitious or reliable in relation to events that seemed important to the psychologist. For example, if he wanted to observe fear, he would think of a fearful stimulus and thrust it at the infant. If the infant did not appear to be afraid or was not repeatedly afraid, the psychologist concluded that the infant was not afraid yet or that the appearance of fear was not a valid measure of fearfulness. He concluded that fear was not an infant response.

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Another captivating example is seen in the Spitz films.[1] Spitz described the emotion of the 10-day-old infant as bland and undifferentiated.

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Then he showed us a face with eyebrows lowered and drawn together, brow vertically wrinkled, mouth corners down and lips contracted. This configuration is usually identified as rather intense distress, not bland, undifferentiated emotion. More dramatically, the withdrawn and supposedly "passive" unmothered foundlings showed real terror at the approach of Spitz, not the more active wariness and distress or greeting patterns that mothered infants show at the approach of strangers.

Why don't we see this? Cultural taboo? Disorganized or too fleeting a message? I am not certain, although I have some hypotheses, but I do know that this blindness is a real handicap to anyone who would study affect.

Because it is so difficult to reorient oneself to examine affect and to dissociate the affect response from the situational gestalt, I have taken a radical approach for observation. To overcome the first difficulty of examining the face per se, I study facial movement, piece by piece in slow motion, not affect. To overcome the second difficulty, I videotape in conditions in which the situation gestalt is not only unknown, but also unknowable; we tape in a bare room, relatively speaking. During the taping the noise and light level remains constant and nothing "happens" which we could relate to changes in the infant's affect. By these strategems we force ourselves to study the infant's face carefully. Once we had discovered what there was to be seen, then we would attempt to interpret it, but first we wanted an "abstract" picture.[2]

This study of infant affect was begun 2 1/2 years ago when I was presented with my own personal subject pool--fraternal twins, a boy and a girl. Starting when the twins were 10 days old, we filmed more or less weekly. The infants were always awake and quiet when we began filming. Thus we have longitudinal

records of two infants from which we could examine the ontogeny of facial expressions.

There are many levels of analysis that could be performed on such data. We developed an ethogram of the face--modeling from Blurton Jones (1971). As we attempted to train coders to use the ethogram we discovered that it is necessary to assess the movement of the eyebrow, eye direction, eye openness, mouth shape, mouth position, lip position and tongue protrusion independently. Actually, this is not a new approach.

The 19th century physiologist, Duchenne (1862), pointed out in his description of affect that it is necessary to examine the separate muscular structures of the face. Otherwise the dominant part will persuade the observer that the entire face has changed in sympathy with the part. We also found it necessary to establish an ordinal scale of measurement since all faces differ in lability, size, shape and prominence of the features. It is also necessary to examine change and movement rather than stereotypic "stills" (e.g., photographs). Once these three rules of observation are followed, any observers can readily agree on the change of any part of the face.[3]

From these observations of facial movement, we have developed hypotheses about the innateness of affect, the perception of affect and the meaning of affect. These observations and hypotheses are of critical importance to observers of caretaker-infant interactions, personality development, intelligence test construction and the understanding of individual patterns of development.

Almost all the facial movements that we observed were first observed in the first month, that is during the neonatal period. This means that all movements that we would commonly call smile, frown, angry grimace, excitement, boredom, sorrow, joy, shame--the great range of emotional expressivity--are possible from the beginning of life (at least the second or third week) and probably before. Even asymmetrical brow raisings or lip corner twitchings occur,

so that "skepticism" or a "half-smile" are possible. This is not entirely an unexpected observation. Everyone confirms the observation of neonatal startle, cries, nose wrinkle and head aversion. Some acute observers have even noted a neonatal or endogenous smile--the popular "gas-bubble." Nevertheless we were not expecting to find the entire range of affect in the supposedly non-social and "emotionally diffuse" infant. For example, we do not yet know that observers would perceive an angry grimace as a meaningful angry message. All we know is that the "anger" configuration is possible for very young infants (2-4 weeks) and does appear.

This is very strong evidence in favor of the hypothesis that affect patterns are innately determined. Further study may indicate that the sequences of affect patterns, their attenuations and exaggerations will change as the infant learns the correct or appropriate affect or as affects become determinants of each other. These changes have been discussed by Tomkins as functions of drive, affect itself and cognition.

We do not know from this evidence whether these affects merely play across the face in a fleeting and senseless display or whether in some sense they have meaning and reflect the infant's feelings or internal state. We will come back to this point later. Before considering it, it is necessary to consider the individual affect patterns.

Even the briefest examinations of the tapes show that the twins are quite different in the portrayal of affect. These differences are reliable and stable from the second week after birth to the second year. An examination of each area of the face indicates the nature of these differences most clearly.

Brow positions are nearly identical. The most common position is the relaxed or normal position. The next most common position is the slightly

raised brow. Slightly raised brows give the face a quizzical, or curious look and combined with widely opened eyes indicate interest to the observer. Although the twins do not differ on brow position, I have films of other young children who are quite different. In particular, a series of films taken in Chiapas, Mexico, of Zinacanteco Indian children shows a weak frown to be extremely common and the raised or slightly raised brow was never seen.[4]

Eye openness is a feature which distinguishes the twins (see Figure 1). Lizbeth's eyes are most frequently a bit wide, whereas Alex's eyes are either normal or a bit narrow. In the case of eye openness Alex is more variable with more even distribution across all categories than Lizbeth.

The direction of glancing is also quite different (see Figure 2). Of course, both babies most frequently look straight ahead, but the second most frequent directions for Lizbeth are "side" and "up," and the second most frequent directions for Alex are "down" or "down and to the side."

The relaxed or the slightly squared upper lip may also be a relaxed position for infants. Lizbeth's mouth movements are fairly evenly distributed over all possible positions. This is also true of lip positions. Alex's lips are almost always in the relaxed position (75% of the time), whereas Lizbeth's movements are more variable. Tongue positions are nearly identical for both infants with the positions appearing in this order: tongue invisible, visible, pushed forward, out of mouth.

To a mouth-oriented observer, it would appear that Lizbeth is the more active infant, her movements are more variable and the mouth area of the face is seldom seen at rest. Her interest and responses are easily intuited from mouth movements. On the other hand, Alex's mouth is commonly still and relaxed. Little information about his interest, motives and response comes from the mouth area of the face. This relaxation gives rise

to several reactions from observers. The first impression one has is that Alex is a relatively calm and passive infant. However, this is contrasted with the fact that mouth movements appear to be very dramatic on Alex's face and command an unusual amount of attention. Consequently his reactions are sometimes seen as more extreme than Lizbeth's.

To the eye-oriented observer Alex appears to be more active and variable; he may also appear to avoid eye-contact because he looks down and to the side so frequently. On the other hand, Lizbeth with eyes directed ahead or up and opened a bit wide is very appealing and often seems to be asking for interaction in the traditional supplicant manner with eyes raised.

Differences in areas of the face used to express interest and awareness, curiosity and understanding do not seem to be significant indicators of intellectual differences in infants as measured on scales such as the Bayley, at least as far as the twins are concerned. They reflect a style of responding more than a quantitative difference in responsiveness. The attentive observer can "read" affect from partial cues of either mouth or eye. But the "still" examples of the most frequent expressions only begin to describe the differences. Another aspect of facial communication is the relationship of "figure to ground." This involves both descriptions of "figure" and "ground" and the relationship between figure and ground. The phenomenon being described is easy to illustrate but difficult to analyze. In the instance of babies Alex and Lizbeth we note that Alex is most frequently "at rest" or "normal:" that is, his facial expression is most passive; his "ground" is very bland. Lizbeth seems also frequently resting, but the frequency is significantly lower than Alex's. Lizbeth as she grows older is less frequently seen at rest than Alex. This accounts for the description by observers of Alex

as more extreme in affect. His change in facial expression occurs less frequently and occurs on a predominantly bland background giving an observer the impression that his smiles are happier, his frowns unhappier. Lizbeth seems to be more even-tempered because the "ground" expression is more active than Alex's.

It is interesting and invites speculation when the spontaneous descriptions of relatives and passers-by[5] are noted in conjunction with the schema presented above. Lizbeth was called by fanciful, endearing names such as "little Pumpkin," "woozel," "sweetie" and so on; Alex was called "the judge," "a cool customer" and other rather unusual names. It would be rash to suggest facial expression determines people's view of their intelligence and personality in any sense, but it would be foolish to ignore the possibility that the infant's facial expression has some control over the social responses of his observers and caretakers.

Thus we see that the twins present two different faces to the world. Further, these "faces" are remarkably stable, representing consistent individual differences in affect. We wondered whether these faces, these common affects were reflective of internal states. We recorded and analysed electrocardiogram data during periods of attending to novel visual and auditory stimuli and during habituation to auditory and visual stimuli. The results of this simple test support the notion that the face reveals the state of the heart.[6]

Lizbeth is a model subject for such a habituation study. Her heart rate is relatively labile, but clearly decelerates during the presentations of novel stimuli and decelerates proportionally less with the repeated presentations. Eye widening follows a similar pattern; one might also say that the mouth movements decelerate in concordance with the heart. Alex's heart rate tells a different story. First, one notes that it is extremely stable;

secondly there is no discernable deceleration upon presentation of novel stimuli. Yet Alex's eyes widen slightly and he looks at the stimuli. He doesn't look particularly interested, although he saw them and labeled them at two years of age.

In a second pilot study we confirmed this correlationship relationship between affect and heart rate. Four out of five three-month-old infants show a close correspondence. The fifth, if she is attending to the stimulus at all, shows a bit of eye widening, but has no discernable heart deceleration. This may mean that affect is a more sensitive indicator of interest and attention than heart rate.

I think we can agree from these studies that the evidence strongly favors the hypothesis that affect is innately determined and meaningful. The early appearance of affective expression, its stability and its correlation with a physiological indice of attention and arousal would support the hypothesis.

The evidence from these studies is in substantial agreement with Tomkins (1962) and Ekman and Friesen (1971) on this issue. Although Bridges (1930), Watson (1920) and others argued that only two or three affects could be innate and the rest at least partly learned, the evidence is more supportive of the hypothesis that all the ability to produce any affect is innate and operant during the first month after birth. The observations of Ambrose (1961) on smiling and Wolffe (1969) on crying also support the hypothesis. There is even some clinical evidence (cases of stroke resulting in facial paralysis) that the affective responses can be involuntarily released in adults.

Tomkins (1962) has argued that there are innate "releasers" of affect as well as the learned "releasers" of memory, imagination, thinking and affect itself. Further study is needed in this area, but at least we now know that

the affects can be perceived so that innate activators may indeed be discovered for all affects. A few of the learned activators (e.g., strangers, mothers, tickling) have been described by other members of this symposium and are commonly considered the only releasers of affect, although Sroufe's (1975) work begins to reveal the important ontogenetic changes that occur both in "releasers" and in "smiling."

Physiological differences in attention and arousal are related to the affect of attention and arousal in the two infants studied for over two years. Physiological changes may also co-occur with other infant affect responses. This would be a rewarding topic for further study. The co-occurrence of facial change and heart rate change suggest that the observed infant affect is a reflection of the infant's internal state, not a random patterning or a babble waiting to be organized linguistically. Further, the affect patterns reflect stable individual differences between the infants studied. Other studies from our laboratory support the hypothesis that these differences are stable for other infants. The evidence from the twins is most convincing because of the longevity of the difference.

I would predict, however, that both the simple relationship of affect and internal physiological state and stable patterns of affect will be attenuated as the learned releasers of affect come to play a more important role in determining affect. The question at this point becomes far more complex because memory and thinking will overlay the innate patterns creating learned individual differences and learned similarities. For example, although the analysis is not up-to-date, more recent data on the twins suggests that they are becoming more similar as they grow older. The effects of similar environments, each other, and verbal communication seem to have made inroads on strong innate differences. In some cases,

however, the original differences might be exaggerated as the adults who surround the child learn to adapt their behavior to the idiosyncracies of the child. The results of Kagan and Moss' (1962) longitudinal studies of reinforced and non-reinforced sex-related personality features would be relevant to this issue.

In summary I have argued that the infant's affect patterns indicate that affects are innate, probably connected to unlearned releasers and are meaningful indicators of individual difference. These hypotheses have far-reaching implications for developmental psychology inasmuch as affect is a significant determinant of cognitive and social development as well as the outward aspect of each infant's unique way of feeling about himself. Within the limits of cultural belief and taboo, care-taking adults react to infant affect as a symbol of infant personality. It is past time for us to overcome the taboo on looking at the face and examining it, for there is a message in the infant's face.

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Footnotes

[1]The films "Grief" and "The Genesis of Emotion" were shown at SRCD, Denver, 1975.

[2]It is also possible to attribute this infant affect in a nonstimulating environment to infant fantasy or imagery. The possibility of studying daydreaming or night dreaming through affect is suggested by this approach.

[3]Interobserver agreements range from 97% for eye openness to 80% for lip position, reflecting the complexity of muscular structure of different parts of the face.

[4]This lack of the slightly raised brow may account partially for the observation of several researchers (e.g., Brazelton, 1972) that the Zinacanteco infants are not "curious."

[5]The twins occupied a corner of my office during their first year. I recorded the "names" given to them by passing students and faculty.

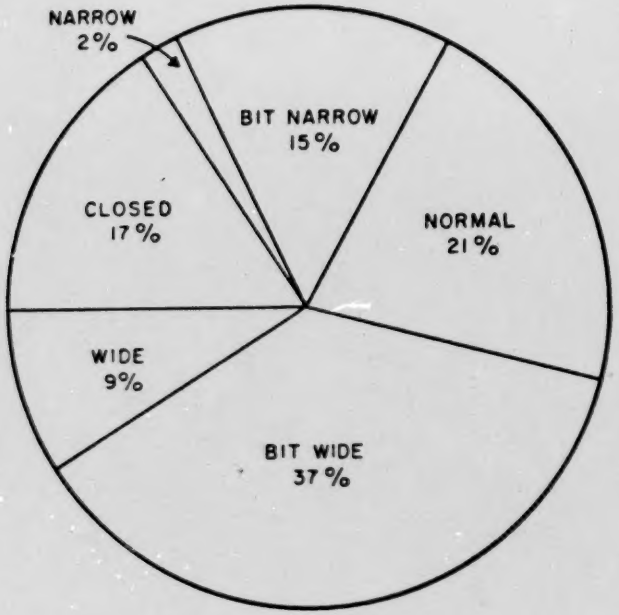
[6]I would like to thank Michael Lewis, Elizabeth Judd and Sherrill Lord for their assistance and helpful recommendations in this project.

Figure Captions

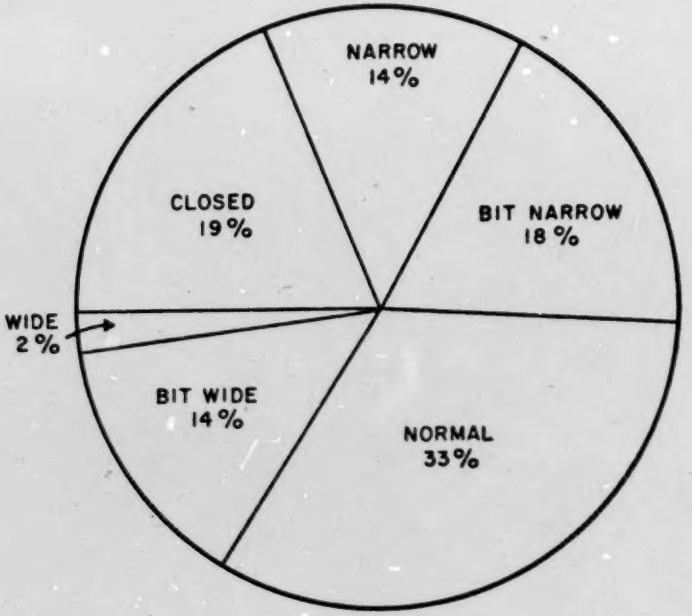
Figure 1. Eye openness: The frequencies of eye openness positions for a set of fraternal twins. These are computed from bi-monthly 5-minute segments of videotape taken over a 2-year period starting at the second week after birth.

Figure 2. Eye direction: The frequencies of eye directions for a set of fraternal twins. These are computed from bi-monthly 5-minute segments of videotape taken over a 2-year period starting at the second week after birth.

Figure 3. Schematic drawings of the most common facial configurations for Liz and Al.



LIZ



AL

I EYE OPENNESS

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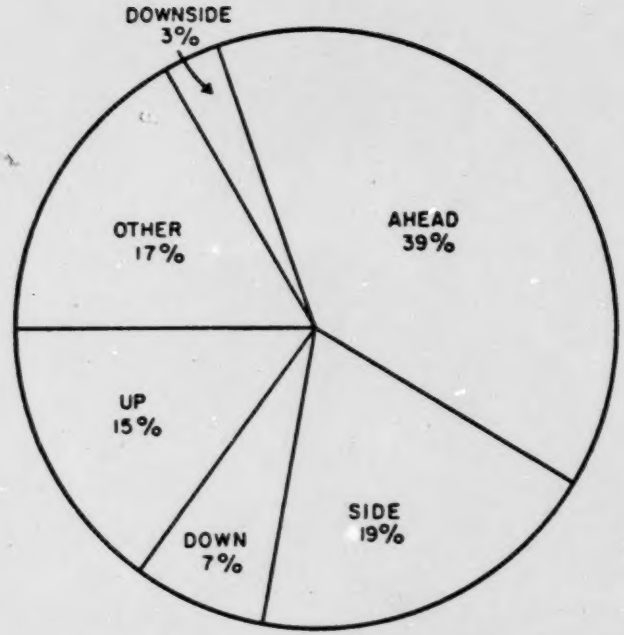
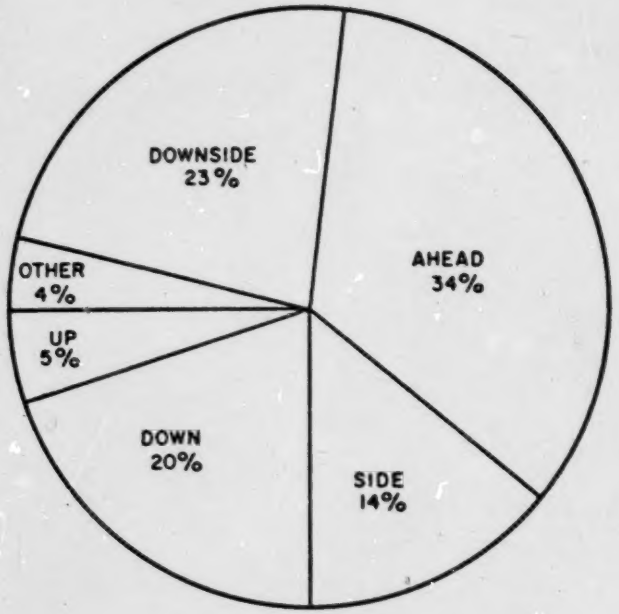


LIZ



AL

II EYE DIRECTION

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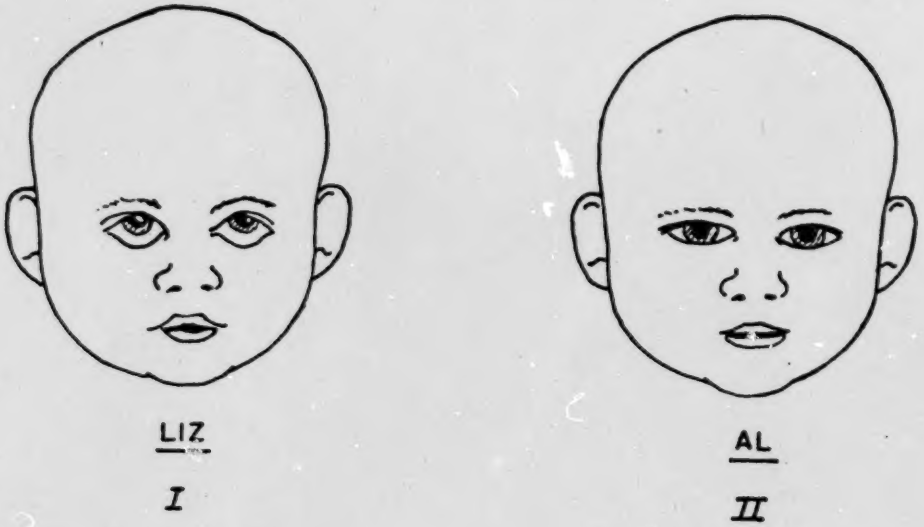

FIGURE III